In a world with 10 billion people, what will 8 billion do?

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If 100 million families produce all the needed food, another 200 million manufacture all the necessary and essential goods, and 300 million provide high-level services, what will the rest do?

Issue: Is maintaining Western/liberal democracy under threat from "the rest"?

"Western democracy is characterized by fair, free, and competitive elections between multiple distinct political parties; a separation of powers into different branches of government; the rule of law in everyday life as part of an open society; and the equal protection of human rights, civil rights, civil liberties, and political freedoms for all people." (Wikipedia)

Key Societal Intervention Benchmark: Creating Enough Jobs to Prevent Generational Poverty
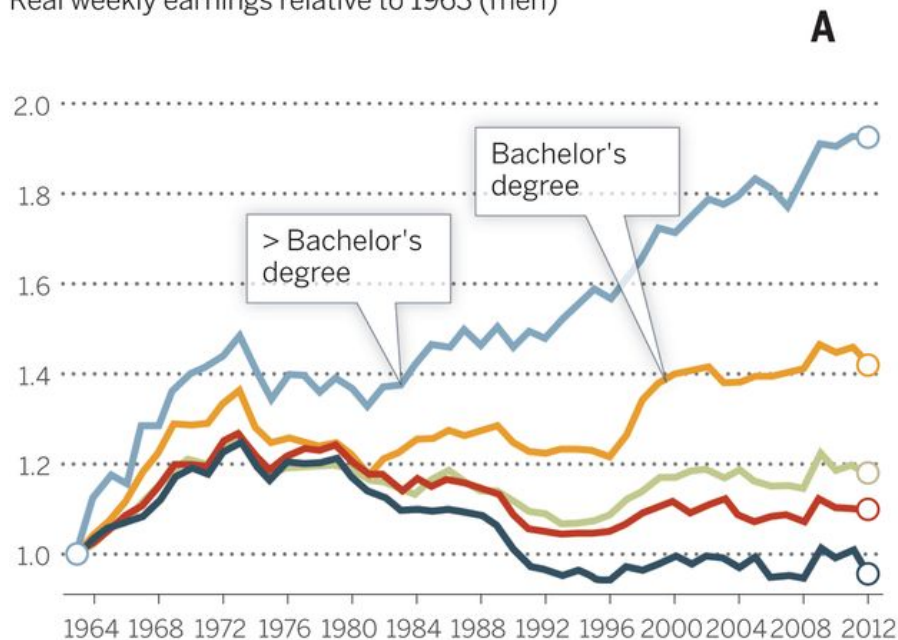
- Otherwise families are caught in a downward spiral that creates impediments for children to break free
  - Poor prenatal care
  - Poor nutrition
  - Poor health care
  - Sub-standard education
  - Living in an environment of crime and insecurity
  - Inadequate supervision, support, mentoring and role models
  - Stressful—abusive conditions at home & neighborhood
  - **Lack of opportunities and hope**

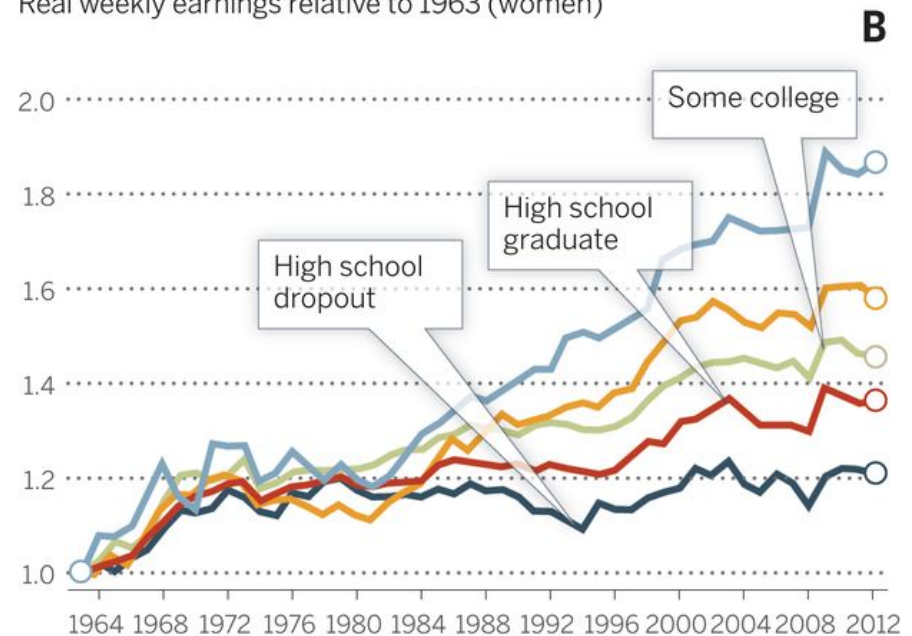Kids (i) lose hope and drop out, (ii) subsist, (iii) migrate, …

1980 – a turning point
in the value of Bachelor+ degree

Changes in real wage levels of full-time U.S. workers by sex and education, 1963–2012

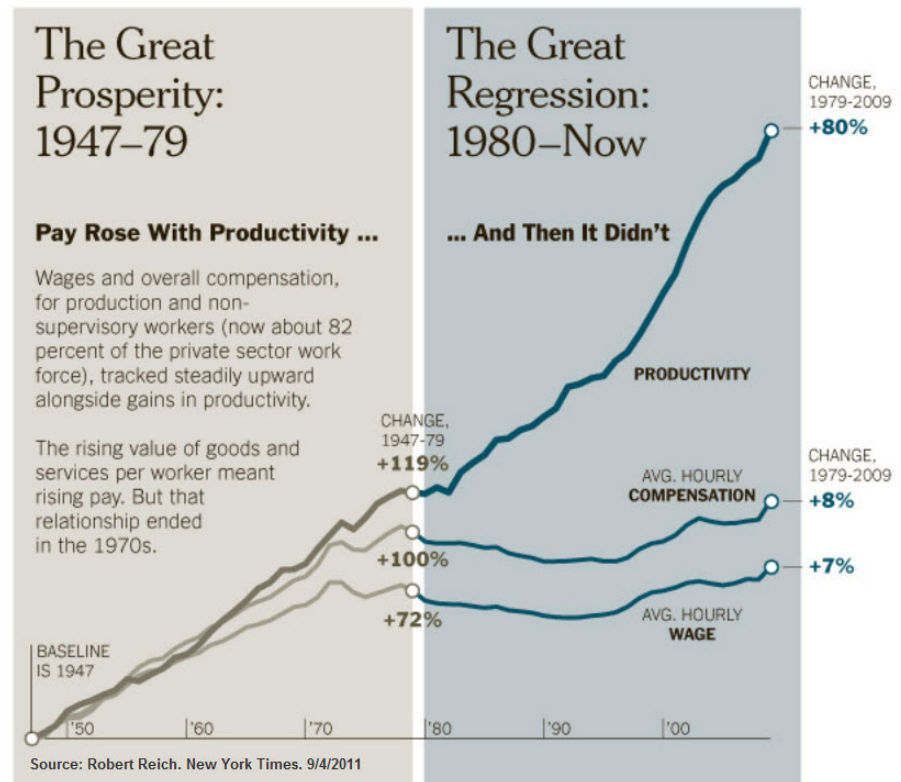Real weekly earnings relative to 1963 (men) — A

Real weekly earnings relative to 1963 (women) — B

Labels: Bachelor's degree, > Bachelor's degree, Some college, High school graduate, High school dropout

https://ourworldindata.org/skill-premium-income-by-education/

Jobs and wages that provide enough resources to families to prevent generational poverty have not grown since 1980 while the global population and its expectations continue to grow

1980: a second turning point

USA: Disconnect between productivity and worker's compensation

The Great Prosperity: 1947–79

Pay Rose With Productivity ...

Wages and overall compensation, for production and non-supervisory workers (now about 82 percent of the private sector work force), tracked steadily upward alongside gains in productivity.

The rising value of goods and services per worker meant rising pay. But that relationship ended in the 1970s.

CHANGE, 1947-79
+119%

+100%

+72%

BASELINE IS 1947

'50   '60   '70

The Great Regression: 1980–Now

... And Then It Didn't

PRODUCTIVITY

CHANGE, 1979-2009
+80%

AVG. HOURLY COMPENSATION

CHANGE, 1979-2009
+8%

+7%

AVG. HOURLY WAGE

'80   '90   '00

Source: Robert Reich. New York Times. 9/4/2011

Job Creation: mainly under 30K/year

- Part-time volatile jobs

- Huge competition for all jobs

- Few opportunities for growth

- Few benefits

- Companies asking employees to avail government benefits (food stamps, health care, …) to supplement income → Partial wards of the state

- High probability of generational poverty

Income inequality reduces tax base.
How does one pay for their growing burden?
Revisit the relation between work and compensation?

Who will take care of those that falter or fall off the table?

They need help to climb back up

- Support of family & friends
- Community safety nets / NGOs
- National programs / NGOs
- International programs / NGOs

Social Contract

In liberal democracies, the state is stepping in & people become [partial] wards of the state

As more need help, the state grows correspondingly. Must collect more taxes for infrastructure & expenses

The innovators, entrepreneurs and leaders are the new nobility: Sky is their limit

They set the bar for expectations for the global population

Other jobs that are highly valued / needed
- Entertainers (sports, music, TV, movies, art, performing arts, …)
- Doctors
- Teachers / Researchers
- Government

Is the fraction of the population that feels sufficiently empowered (hopeful) large enough to provide stability?

Understanding and Adapting to Changes in the Job Market at Warp Speed

Destructive Technologies

…

iRobots

Computers, robots, automation are rapidly changing how we produce goods, exploit resources and provide services

- Typical rules-based tasks can be 70-80% automated
    - Sorting, assembly (automobile industry), …
- Standardized transactions
    - Online banking
    - Inventory & checkout using barcode scanning machines
    - Internet retailers
    - Ipads replacing waiters in restaurant chains
    - …
- Robots/Computers better suited to perform tasks that are difficult, dangerous or boring (repetitive & standardized)

Robots

- Mechanical (Industrial) Robots / Robotic arm
  - Cartesian robot / Gantry robot
  - Cylindrical robot
  - Spherical/Polar robot
  - SCARA robot
  - Articulated robot
  - Parallel robot
- Sensing, mobile robots in extreme environments
  - Self driving cars
  - Space (ROV, ROVER, RMS)
  - Deep sea vehicles
  - Radioactive environments
  - Bomb defusing, …
- Healthcare: Computer/robot assisted surgery, …
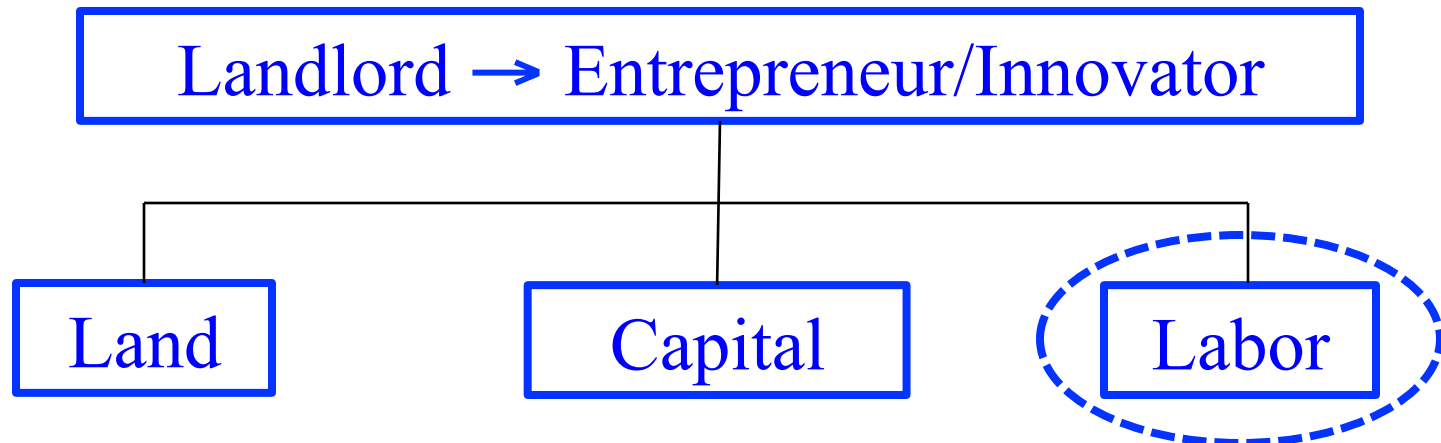- Software Robots: Robotic Process Automation (RPA)

Machine vision
Motion detection

Ultimate goal: Recognize and manipulate any object in any configuration.

250 years of industrial revolution

- Industrial revolution
  - Low tech → High tech
  - Routine → Intellectual
  - Untrained → Highly trained

Need for large numbers of workers persisted

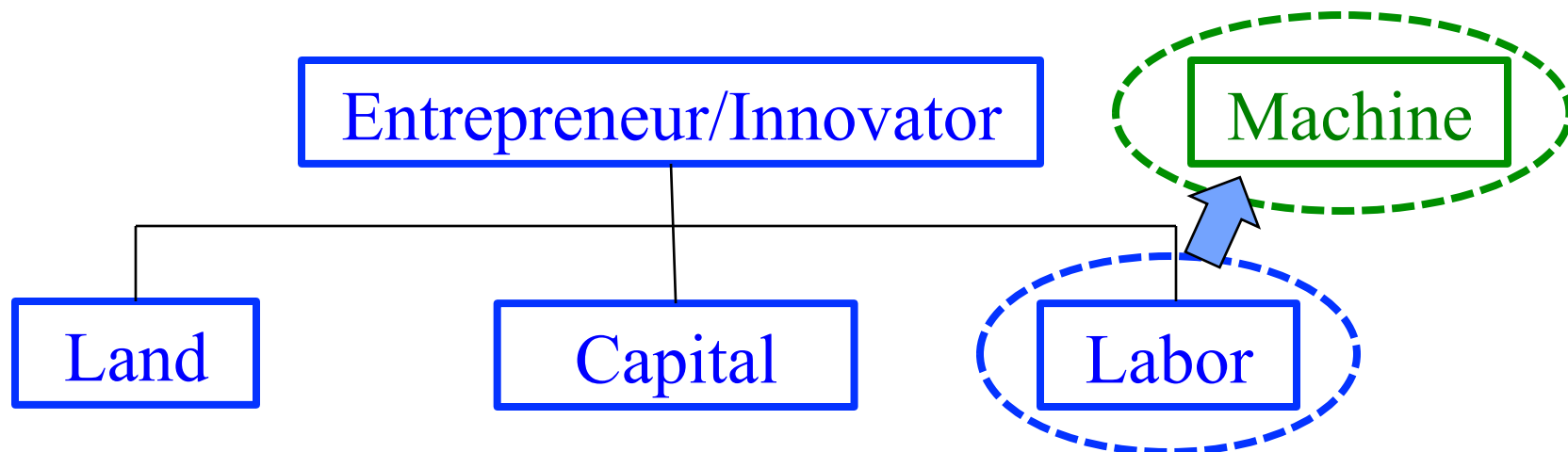Landlord → Entrepreneur/Innovator

Land

Capital

Labor

AI: Are only labor intensive jobs threatened?

No profession is safe
- High tech and low tech
- Intellectual and routine
- Highly trained and untrained

Pattern Recognition:
Big Data
Machine Learning
Deep Learning

Watson, Eureqa, AlphaGo, …

Entrepreneur/Innovator

Machine

Land

Capital

Labor

A Robotic Society

- Self-service retail: Vending machines, Kiosks
- Online retail (Amazon, … Netflix need fewer workers as inventory control, sorting, packaging & dispatch becomes fully automated)
- Self drive cars (add years of mobility for the elderly)
  - Pittsburgh Uber
- Converting fact based events (sports) into news clips
- ….

Competing for Jobs: Humans versus Machines?
Humans need to continuously upgrade their skills!

iRobots: the stars are aligned

- Relentless innovation in machines, robots, computers, algorithms, analytics, …(Innovators are maniacally driven and energized by the endless possibilities)

- High incentive for businesses to automate: intelligent machines replacing error prone…temperamental humans

- *Computers and algorithms: first machine powerful enough to encroach on human cognition, analysis, flexibility and decision making (AI)*

- Cost over relatively cheap labor [historically] is the only significant hurdle. Advantage diminishing rapidly!

- Capital/investors, innovators become more important
- Loss of jobs is the one societal drawback

More and more jobs are being targeted

- Radiologists → outsourced → robots with pattern recognition and AI capabilities

- Internet shopping (Amazon.com): much fewer humans currently supervise, package, ship, follow up

- Customer service → outsourced → FAQ automated → fully automated

- No Middle Person: Airlines, hotels,… → incentivize web bookings

- Taxis → self drive cars for hire (Uber in Pittsburgh)

- …

Self-drive cars & Google maps → extends mobility of handicapped and elderly

Coming generations: more comfortable interfacing with computers

Future of the garment industry

Custom-made boutique clothing foe the well-to-do

- – E-mail 3 photos of self to a web based "tailor"
- – She digitizes and designs a desired fit and look
- – Sends 3D (hologram) display for your approval
- – Garment produced anywhere (USA) in the world
- – Ship to door in < 2 weeks

What is the premium today & what will it be in 10 years?

Safe jobs:
- • Designers
- • Computer programmers
- • Automated cutting and stitching machine manufacturers

Traditionally, the entry point for low labor wage countries

Many technologies have plateaued: Changes are incremental

Focus: **automation & integration**

- Appliances: washing & drying machines, refrigerators, dishwashers, air conditioners

- Automobiles

- Jet engines for passenger aircrafts

- …

Innovations (& Jobs) are in areas of deep knowledge: genomics, medicine, materials, computers, AI, …

Windows of Opportunity
are of Limited Time Extent.

Key: infrastructure, education,
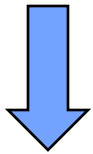health care &
socio-cultural-political factors

Individuals–Countries get/create windows of opportunity

- Oil and Gas: Persian Gulf countries, Russia, Venezuela, Nigeria, Angola, … (1960–2040)
  - Putin (2000–) could make Russia an economic powerhouse

- China (1980s–2030?) low wage skilled labor
- Western world (1945–): Outstanding educational institutes creating a culture of research, innovation & entrepreneurship. Will it maintain its social contract?
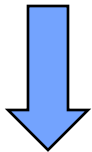
Need entrepreneurs & good governance to avail opportunities

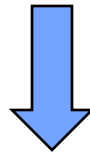# In an information age with smart machines

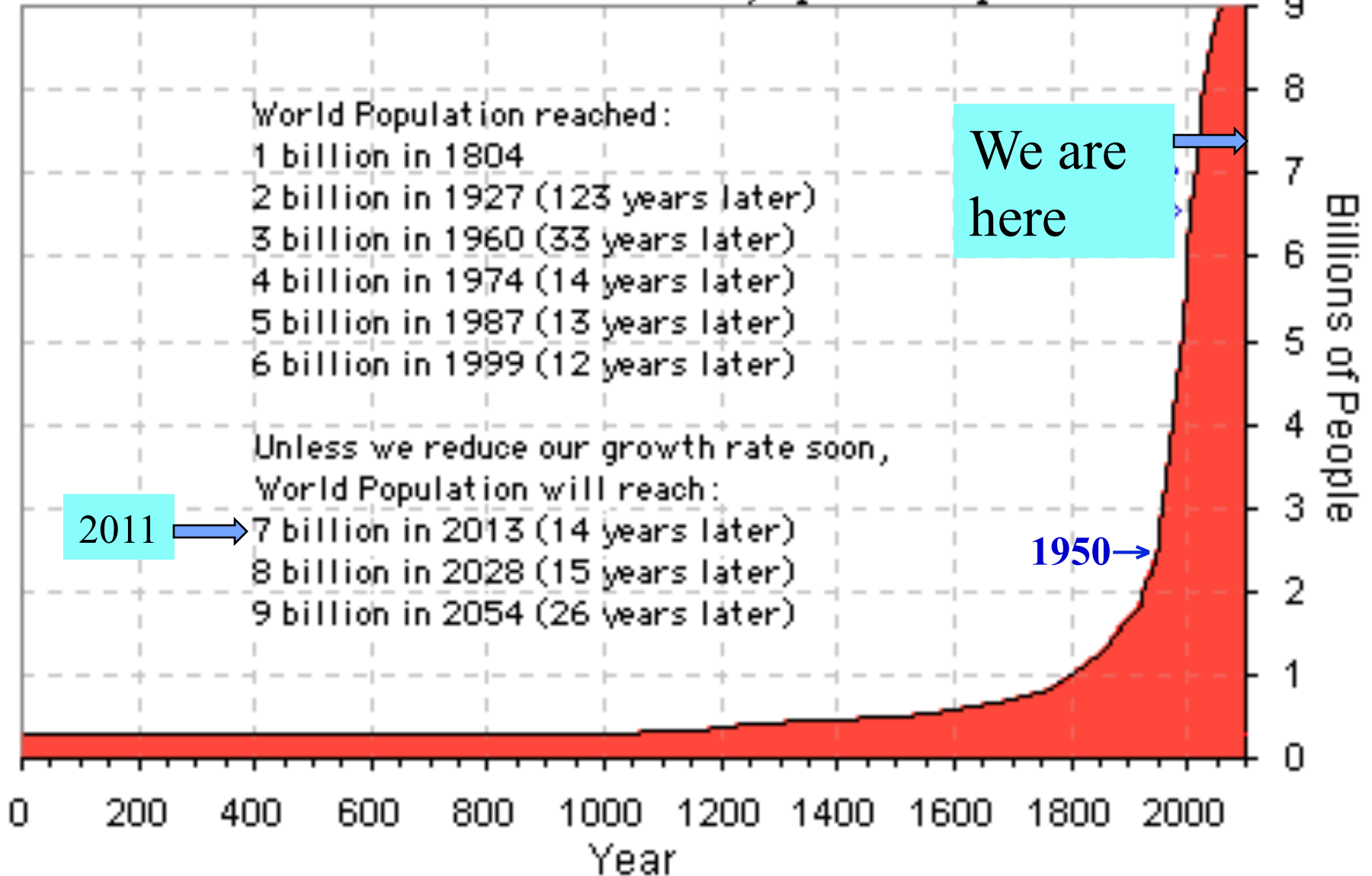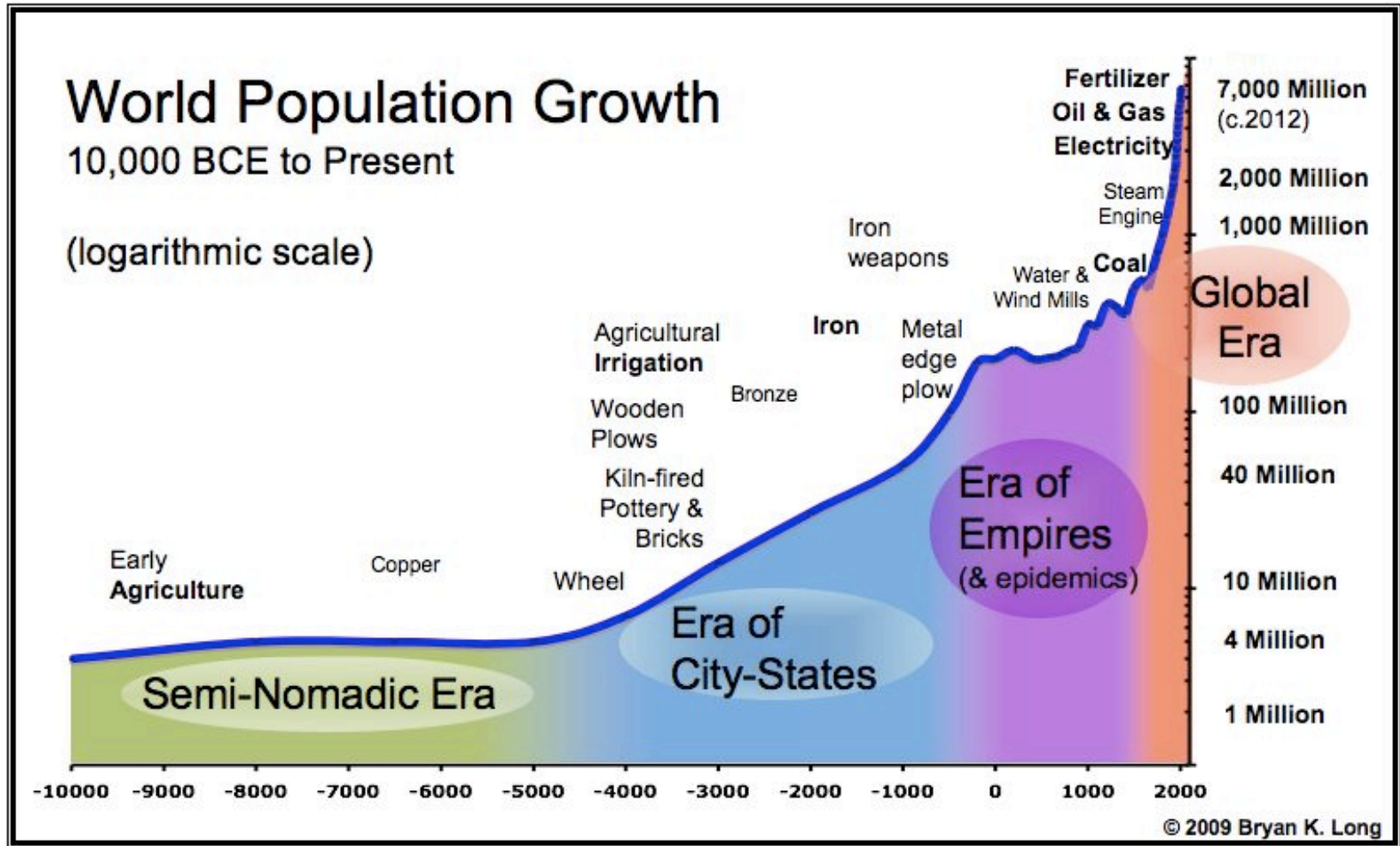| Comparative Advantage	Opportunity Cost	For testing Ideas: Entry Barrier → 0
↓	↓	↓
Can be duplicated	Replaced by machines	But gains are highly uneven
↓		↓
Raising the Bar		Winner takes all

In the coming era of iRobots, is the current population [growth] sustainable?

Population Growth

Source: United Nations, Population Prospects: 2004 Revision

World Population reached:
1 billion in 1804
2 billion in 1927 (123 years later)
3 billion in 1960 (33 years later)
4 billion in 1974 (14 years later)
5 billion in 1987 (13 years later)
6 billion in 1999 (12 years later)

Unless we reduce our growth rate soon,
World Population will reach:
7 billion in 2013 (14 years later)
8 billion in 2028 (15 years later)
9 billion in 2054 (26 years later)

We are here

2011
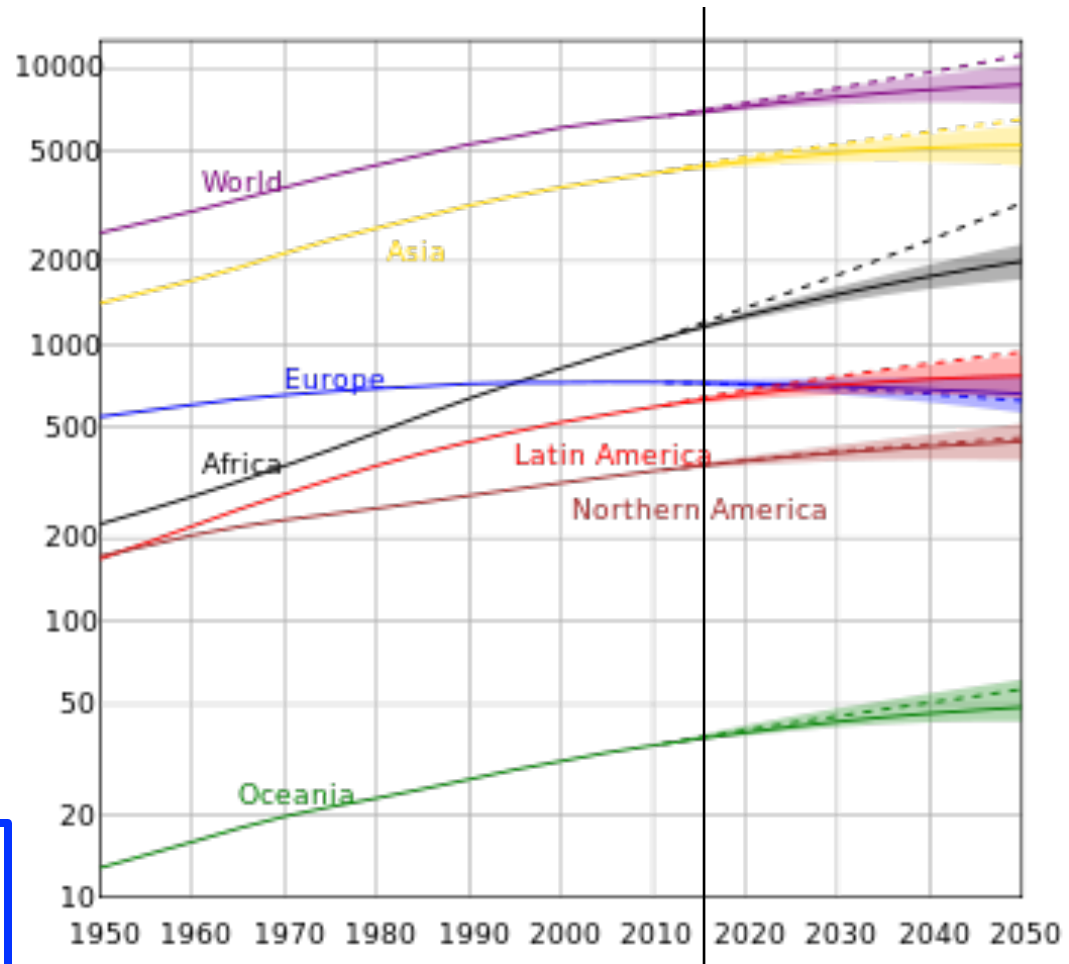
1950→

Population Growth

New technologies supported more people and created need for more people

Will lack of jobs become the key determinant
of global population/demographic stability?

Areas of Population Growth

- Africa
- South Asia
  - Pakistan
  - India
  - Bangladesh
- Middle East

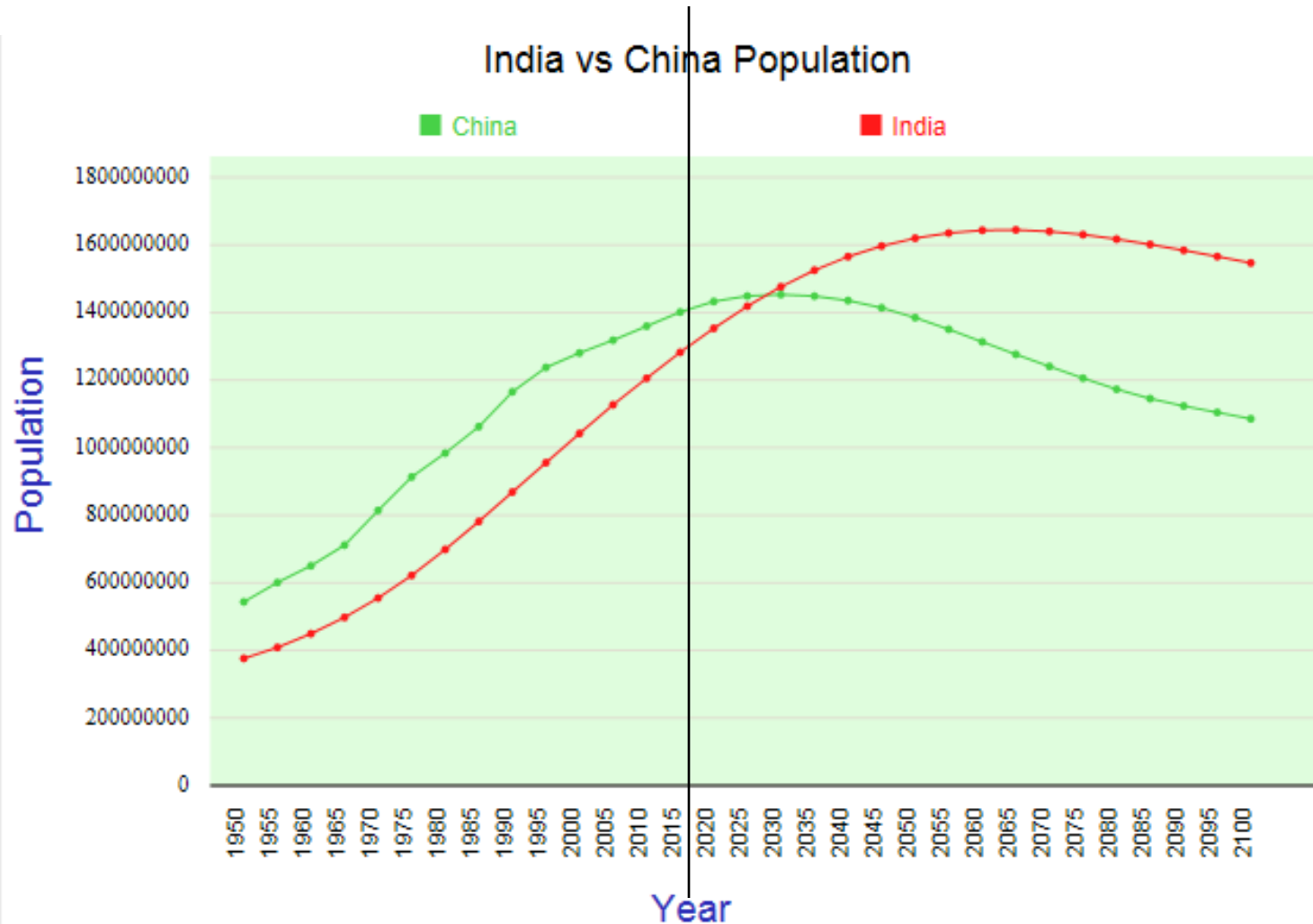The growth is almost entirely within the poor

Population Clock, 2016

		WORLD	MORE DEVELOPED COUNTRIES	LESS DEVELOPED COUNTRIES
Population		7,418,151,841	1,254,309,821	6,163,842,020
Births per	Year	147,183,065	13,714,857	133,468,215
	Day	403,241	37,575	365,666
	Minute	280	26	254
Deaths per	Year	57,387,752	12,580,616	44,807,108
	Day	157,227	34,467	122,759
	Minute	109	24	85
Natural increase per	Year	89,795,313	1,134,242	88,661,107
	Day	246,015	3,108	242,907
	Minute	171	2	169
Infant deaths per	Year	5,226,233	65,229	5,160,998
	Day	14,318	179	14,140
	Minute	10	0.1	10

Population Reference Bureau: http://www.prb.org/

Poor nutrition, education and health care: India's population growth is a liability

India vs China Population

China will continue to have 600+ million people of working age (20-60) through 2040

Direct consequences of population growth and rising expectations

- Climate change
- Pollution and environmental degradation
  - Salination/Degradation of agricultural lands due to overuse
- Depletion of natural resources and biodiversity
- Strife (consequence of resource & ethnic conflict)
  - Rwanda (Hutus and Tutsi)
  - Darfur (Janjaweed versus the sedentary population)
  - South Asia
  - Former Yugoslavia
  - Middle East
- **Migration**

What will be the nature of the social contract in the future if population continues to grow in poor unstable communities or countries?

The human species is unique

It has no natural competitor and sits on top of the predator prey chain

Innovation and Technology has allowed it to thrive in harsh inhospitable climates, grow abundant food, exploit deep buried resources, elongate life, …

The needs, expectations and consumption of natural resources by individuals continues to grow along with the growth proportional to total number of people

Will technology, in the near future, reduce job prospects for most of the global population?

How will it adapt?

Migration

continues to be a powerful defining force in human history

Without land to live on in the villages & without skills to flourish in the cities
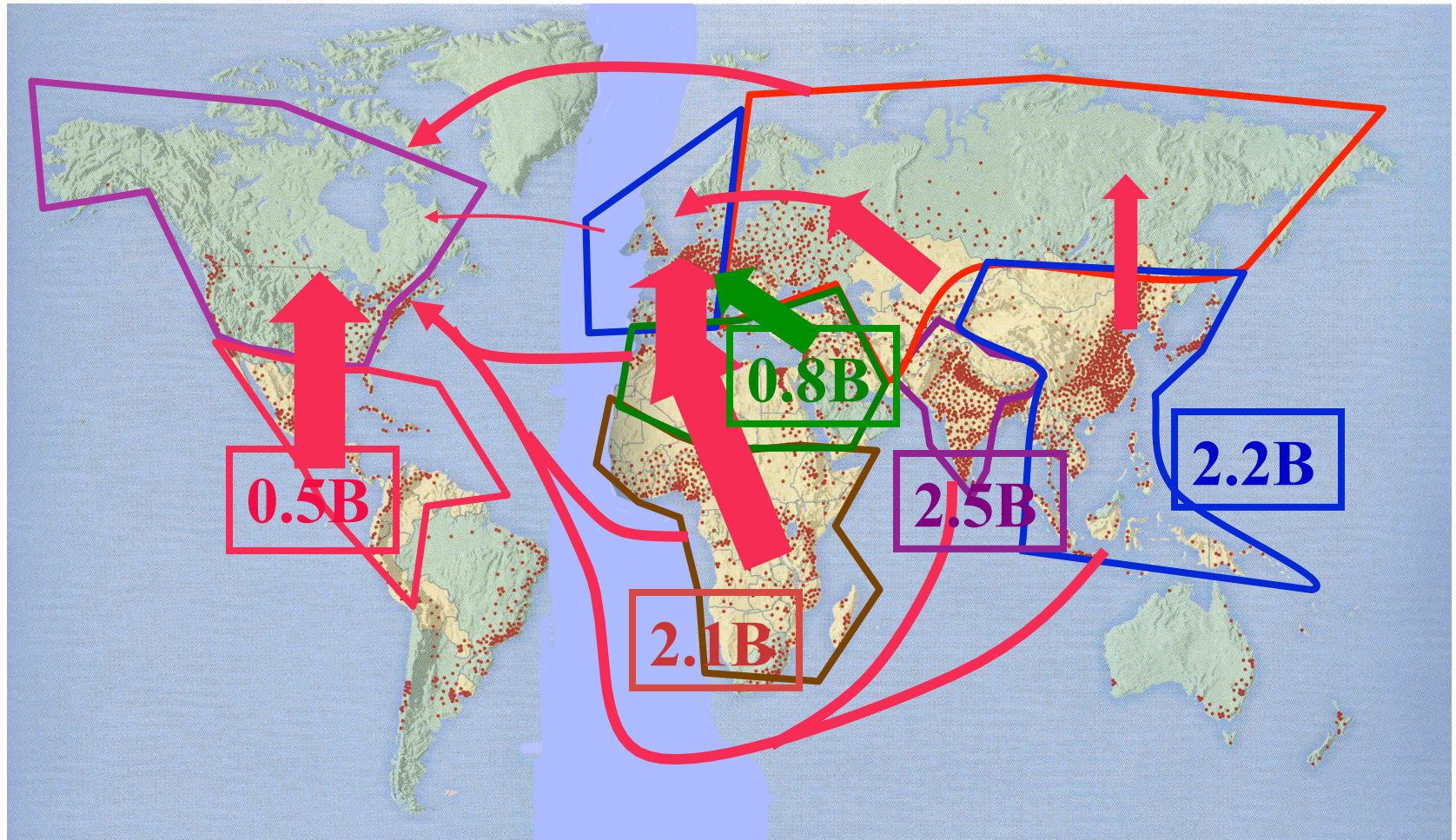
- High population growth countries are in the midst of [stuck in] delayed urbanization & industrialization
- Diminishing land holdings, climate change, lack of local prospects for jobs are forcing people into cities
  - The world reached 54% urbanization in 2016
- To the unskilled, cities offer
  - Low-paying menial jobs
  - A life in overcrowded and unsanitary slums
  - Often abusive conditions
- What precipitates the decision to migrate?

Conditions conducive to migration

- Escape from stagnation, poverty, abuse, war, …

- Promise and knowledge of a better life elsewhere (Internet, previous migrants, global travellers, …)

- A way to get there (possibility of death along the way is not a sufficient deterrent). Recruiters & Facilitators

- A support structure to tap into once there (familiar migrant communities)

- Institutions, laws, societal tolerance and jobs for workers in destination countries → liberal democracies

- Dramatic reduction in fertility rates in the EU

- Opportunities for hard workers

Pressure of migration: 8B vs 2B

0.5B

0.8B

2.1B

2.5B

2.2B

Adaptation and integration or conflict?

Countries can "safely" absorb X migrants per year: Push & Pull

- Provide food, shelter and other necessities
- Services to overcome language, cultural, … barriers
- Adjustment, integration, assimilation
- Number of unfilled jobs (menial – high tech)
- Creating additional jobs
- Job training

Trained people are being recruited from poor countries, depleting their human capital and prospects for growth

Perceived threats of excess migration

- Social, Cultural, Ethnic dilution

- Religion

- Threat to way of life & values

- Growth of "Us" versus "Them" sentiments rather than trust and cooperation

How important are these if the economy is strong?

- Criminals and extremists

- Creates economic hardship (Competition for jobs)

When countries/societies collapse → migration → incoming numbers exceed what host countries want

Many versions of the social contract are being tried/imposed.
Which are sustainable?

In an increasingly complex world without enlightened leadership (defensible tools for careful planning or prioritization), politicians are constantly in a reaction mode and become consumed by power, vested interests and the "next" elections

Democratically Elected Governments Face Many Complex Challenges

Pleasing sensitivities of a million constituencies

- Internet and networking tools
    - Spread awareness and package "issues" for emotional appeal
    - Allow people to reach and network with similarly minded people
    - Create a vocal constituency (single issue advocacy without constraints of fitting into "some" overall structure and goals)
    - Low-cost: unrelenting voices that demand to be heard
- 24/7 media
- Explosion of information is overwhelming and confusing
    - Hard to distinguish between good and not-so-good, right and not-so-right information

→ Hard to maintain a true compass of priorities and goals

Corrupt or Despotic Governments

Do I share the national wealth with X million people or Y thousand cronies?

- Under invest in infrastructure, health care, education
- Creating a competitive workforce and jobs is not a high priority
- Usually profit from exploiting country's natural resources or allowing others to do it for a kickback
- Suppress agitation by people for better opportunities and more freedom. Preserve power by force

They can be toppled, but real change has been rare

Possible paths forward

- Social contract: Distribute work to engage all people
  - What is the minimum sustainable contract
  - Unintended consequences of handouts vis-à-vis payment for [honorable] work
  - In spite of best intentions, will social contracts fail at some point if the population continues to grow
- Self-sufficient communities
- The rich and powerful build walls and armies to
  - Protect / Insulate themselves
  - Suppress and ignore weaker sections of society
- Social turmoil

Population stabilization and reduction

Jobs and Compensation

- Public-Private partnership: create work for all
- Fewer hours/person so that more people work
  - Sweden (6 hour workdays)
- Higher monetary compensation
  - Average teacher salary ~ €10K/year in eastern Europe (ppp factor ~1.7)
- Reduce cost of basics (good education, health care, transportation, …)
- Lower our expectations

Parents/relatives with primary income and savings can shelter children with informal jobs for a while

Social Contracts

- Distribute work and compensation to prevent population sinking into generational poverty
  - A business requires 1000 hours/week of work
    - Hire 25 workers @40 hrs/week and pay each $X
    - Hire 50 workers @20 hrs/week and pay each $X
      ($X/week larger than the generational poverty threshold)

- Parents/relatives with primary income and savings can shelter children with informal jobs for a while ($\rightarrow$ reduced expectations)

At what point do such contracts start to fail?

Will people opt for self-sufficient communities in the 21ˢᵗ century?

- Historically people have
  - Grown their own food
  - Made their own clothes
  - Built homes
  - Created arts and crafts
  - Traded surplus generated

Distributed energy solutions and smaller environmental footprint

- Typically, needs become larger than surplus?
  - Transport (cars)
  - White durables
  - Health Care
  - Higher Education → better and different jobs

Closed societies are not competitive in a free market if they need to import modern amenities, health care, higher education, …

Self-sufficient groups/societies?

- Extended families ➝ Nuclear Families ➝ Extended families (change: reduced # of children to 1−2)

- Self-sufficient communities employ more people.

- Labor is more equitably rewarded

- Different economic paradigm: money / talent based comparative advantage ➝ shared work, community and social activities

- Will kids accept this "stagnation" and stay?

Current experience suggests kids move away

What are the hurdles facing countries aiming for self-sufficiency?

- Question of scale and maintaining competitive industries
  - Greece: Tourism, Agriculture,.. (50% of graduates are leaving Greece)
  - UK but not Scotland as of today
    - Scotland: Oil&Gas, Tourism, Agriculture, Whiskey, Software, but lacks comprehensive manufacturing.
- Countries that may maintain a high living standard
  - USA
  - Western Europe
  - Japan, Korea, Taiwan

If they can solve their energy needs

Interactions with the rest of the world? Protectionism?

Are the 8 billion a reservoir for producing exceptional talent?

Only if they have access to

- Heath care (starting with pre-natal)
- Nutrition
- Education
- Political and social stability

& can migrate as their talents & skills grow

Greece: 50% of graduates are leaving Greece
List of countries with exiting human talent is large

A likely scenario: A perfect storm for the 8 billion

People without adequate resources & without safety nets are most vulnerable to

- Climate change

- Potable Water

- Pandemics – new "plagues"

- Corrupt, despotic, totalitarian governments

- Strife, violence, War

- Desperate to migrate–forcing the West to "build walls"

Ignoring/blocking them threatens the global march towards Western democracy and stability

Lack of Jobs → Frustration and anger against "The Establishment": Unmet expectations in democracies

- The job market is in rapid transition
- 45M Americans owe $1.3 trillion in school debts
- College graduates are not finding "desired" jobs
- Low-paying jobs → path to generational poverty
- Growing income inequality & shrinking middle class
- Can see it, can touch it but cannot have it

- The government is expected to provide help
- The government is perceived to be controlled by the rich and working for the rich

Who pays for the growing burden of the poor?

Scandals, Corruption, Poor Performance and Unmet Expectations are Eroding People's Confidence in Democratically elected Officials even in highly developed countries

3 India Specific Examples

India: delayed urbanization and industrialization

- A lost opportunity? Lee Kuan Yew repeatedly urged India to become a manufacturing hub to balance China since late 1990s

- Late and slow in providing basics
  - Health care, nutrition, education
  - Infrastructure

- Incentives to innovate and excel

India: A second manufacturing hub?
Response inadequate over the last 20 years

600+ million Indians cannot be made 21ˢᵗ century workers in 1 generation

Grew up without

- Pre-natal care of mothers
- Adequate nutrition
- Health care
- Good education
- Job skills

How to prevent generational poverty?

How will they shape politics?

Punjab: An idle society in trouble

- Land prices made landlords phenomenally rich
- Overnight transformation from hard work in fields to a rich life with nothing to do
- Little training or understanding of money management and investment
- Alcohol and drugs (complicit government)